

### **1.0 INTRODUCTION**

PB Farradyne (PBF), a Division of Parsons Brinckerhoff Quade & Douglas, Inc. has undertaken a review of the City's photo enforcement program for the City of San Diego Police Department to accomplish the following objectives:

- Analysis of the existing program for performance and compliance with original design and specification standards; and
- Reassessment of the program's functions, technologies, and governing procedures for the purposes of identifying all potential improvements and to eliminate problem areas which have resulted in negative publicity that may have adversely affected community support for the program.

This report describes the project's findings, conclusions, and recommendations based on a review of red light running violations and accident data trends, system installations, camera unit setups, photographic data, intersection traffic signal timing and operations, and overall program management and operations.

#### **1.1 BACKGROUND**

In 1998, the City of San Diego Police Department contracted with U. S. Public Technologies, Inc., (USPT) for the provision of "red light camera enforcement" technology and services at selected intersections throughout the City. The contract period of performance is for a five- year period. Later that same year, the Lockheed Martin Information Management Services (IMS) Division acquired USPT and its contracts. More recently, Automated Computer Services (ACS) has acquired Lockheed Martin's IMS Division. The acquisition by ACS became effective in October, 2001.

For the purposes of this report when abbreviated reference is appropriate, the City's management services company is referred to as LM/ACS.

The City's photo enforcement system was implemented under the provisions of California Vehicle Code (CVC) Section 21455.5, Traffic Signal Automated Enforcement. This section and related CVC sections clearly define certain requirements for the installation and operation of photo enforcement cameras where the photographs are used as the basis for citations for red light running violations. For example, it is required that advance warning signs be placed at intersections where photo enforcement cameras are installed so that the signs are visible to motorists approaching from any direction where photo enforcement cameras are operational. Alternatively, signs may be posted at all major entrances to the city, including at a minimum, freeways, bridges, and state highway routes, although most cities where photo enforcement systems are operational have elected to install signs at each intersection. As a second example, CVC Section 21455.5 specifies that only a governmental agency, in cooperation with a law enforcement agency, may operate an automated enforcement system. The CVC does not prohibit cities from contracting with firms such as LM/ASC to provide and install the equipment and to provide day-to-day services for system operations and maintenance, and in fact, no cities in California or elsewhere in the United States have undertaken photo enforcement programs without the involvement of contractors to support system installation, operations, and maintenance.

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### **1.1.1 System Description**

The City's photo enforcement system uses equipment manufactured by Gatso, a Dutch company. The equipment is widely deployed throughout the world and is used by a number of cities in California.

The Gatso system provides for the detection of motor vehicles entering the intersection being enforced by inductive loops, similar to the loops that are widely used for traffic signal control and freeway management purposes, and for the recording of red light violations by a high quality 35 mm camera system. The logic required to identify red light running violations and then take two photographs of each violation at pre-determined locations is implemented on a computer processor situated in the camera unit enclosure or housing, using inputs from the vehicle detection loops and traffic signal yellow and red control circuits.

A pair of vehicle detection loops is laid in sealed grooves in each traffic lane to be monitored for red light running violations. The loops are laid in a rectangular configuration, with the long side perpendicular to the curb line. The loops each have three turns of wire and are connected back to the camera unit. Connections from the traffic signal system are also wired directly back into the camera unit for instantaneous recognition of the yellow and red ball indications.



**Figure 1-1  
VIEW OF PHOTO-ENFORCED  
INTERSECTION**

The red light running violations are recorded on a 35 mm film cassette and also on memory cards, where data for each photograph taken is written, that are retrieved from the camera unit on a daily or regular basis. The film is developed and then transferred to high-resolution digital images for further processing and storage. Each of the recorded violations are reviewed by trained technicians to verify that a violation was recorded, that there is a clear view of the motorist's face, and that the license plate number can be clearly determined. For violations that meet these requirements, a citation is prepared and delivered to the Police Department for final review and approval.

### 1.1.2 Method of Operation

The photo enforcement system functions generally as follows.

- For a violation to be recorded, three conditions must be satisfied – first, that the traffic signal display facing the motorist is red; second, that the pre-determined delay or grace time (for example, 0.3 seconds) has expired; and third, that the vehicle speed crossing from the first loop to the second loop is greater than a pre-determined minimum speed threshold (for example, 12 or 15 mph).
- The motorist must be detected crossing both loops, from the first loop to the second loop, at a calculated speed that is greater than the pre-determined minimum speed threshold. Photographs are not taken if the vehicle merely stops over the first loop or if a vehicle is traveling slower than minimum speed threshold. The amount of elapsed time between crossing the first and second loops along with the known distance between the two loops (referred to as the “pitch”) allows the calculation of the vehicle speed.
- Two photographs are taken for each violation. A flash unit is also activated at the same time to assist with lighting for each of the photographs. At selected locations, auxiliary flash units may be employed especially to provide for better second photographs. The first photograph shows the vehicle at the point where it has triggered the second loop. The second photograph is taken at a pre-determined distance from the point where the first photograph is taken, determined to be the preferred or optimal location for the second photograph. This is done by calculating a time interval until the second photograph is taken, based on dividing the pre-determined distance (for example, 40 feet) by the calculated vehicle speed (for example, 15 miles per hour or 22 feet per second).
- The distance between the center point of the first loop and the center point of the second loop, or pitch, needs to be accurately measured and then entered into the camera unit as the basis for estimating vehicle speeds from the first loop to the second loop.
- Both photographs are time and date stamped. The first photograph also has the lane number and yellow time preceding the violation, a sequential violation number, the elapsed red time, and the location identifier. The second photograph shows the time interval between the first and second photographs, the violation number, the elapsed red time at the time of the second photograph, and the calculated vehicle speed. These data are also reproduced on the computer memory card for ease of tracking.
- The first and second loops are installed at all but one location in the City inside the intersection or on the intersection side of the stop line. This installation method means that the actual time of the violation, that is, the precise time when the motorists crossed the stop line facing a red traffic signal indication, needs to be estimated for each recorded violation. In order to establish the position of the vehicle when the signal turned red, a calculation is performed that uses the vehicle speed from the first loop to the second loop and applies that speed to the known distance of the leading edge of the second loop to the trailing edge of the stop line. A grace time period, that varies from

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intersection to intersection and according to the vehicle speed, is allowed before a citation is prepared.

- The camera unit software used for monitoring red light running violations will not generate photographs on either the green or yellow traffic signal light phases, provided that the connections between the traffic signals and camera unit are correctly made. If these connections were not correctly made, the problem would be readily apparent on the photographs taken. Violations are only photographed after the traffic signal has changed to red.
- The vehicle detectors provide a separate output to the camera unit in the event that an in-ground loop become shorted or defective so that baseline inductance changes by more than pre-determined amount. In these instances, the camera unit software used for monitoring red light running violations will not permit photographs to be taken. Again, any problem would be readily apparent on the photographs taken.

### 1.1.3 Red Light Photo Enforcement Locations

Table 1 below lists the 19 locations where the City has deployed photo enforcement cameras. The table shows the date on which operations were commenced at each location, the location identifier, the direction of lane enforcement at each location, and the approximate number of months in service through May 2001. The phased introduction of the photo enforcement cameras was intentional to smooth the gradual increase in workload for the courts as an increasing number of citations were issued.

**Table 1-1  
PHOTO ENFORCEMENT LOCATIONS**

Ref	Code	Description	Effective Date	Approx Months
1	1404	WB El Cajon Boulevard at 43rd Street	07/30/98	34
2	1444	WB Harbor Drive at 32nd Street	12/07/98	30
3	1454	WB Garnet Avenue at Ingraham Street	12/07/98	30
4	1484	WB Imperial Avenue at Euclid Avenue	04/02/99	26
5	1504	WB F Street at 16th Street	04/02/99	26
6	1523	EB A Street at 10th Avenue	02/24/00	14
7	1534	WB Miramar Road at Camino Ruiz	02/24/00	14
8	1542	SB Mission Boulevard at Garnet Avenue	05/19/00	12
9	1551	SB Black Mountain Road at Gemini Avenue	04/20/00	13
10	1553	EB Mira Mesa Boulevard at Scranton Road	04/20/00	13
11	1414	NB Bernardo Center Drive to WB Rancho Bernardo Road	07/30/98	34
12	1422	WB Aero Drive to SB Murphy Canyon Road	07/30/98	34
13	1462	SB College Avenue to Montezuma Road	12/07/98	30
14	1474	WB La Jolla Village Drive at Towne Center Drive	12/07/98	30
15	1492	SB Black Mountain Road to EB Mira Mesa Boulevard	04/02/99	26
16	1513	EB Garnet Avenue to NB Mission Bay Drive	04/02/99	26

**Table 1-1 (Continued)**  
**PHOTO ENFORCEMENT LOCATIONS**

<b>Ref</b>	<b>Code</b>	<b>Description</b>	<b>Effective Date</b>	<b>Approx Months</b>
17	1533	SB Harbor Drive to EB Grape Street	10/07/99	20
18	1541	NB Mission Bay Drive to WB Grand Avenue	05/19/00	12
19	1543	EB Carmel Mountain Road to NB Rancho Carmel Drive	02/24/00	14

## **1.2 REPORT ORGANIZATION**

The report presents the results of the work tasks conducted for the analysis and re-assessment of the City's photo enforcement program. The report has been organized into seven sections, with certain supporting data contained in report appendices. The sections address the City's list of the 11 areas to be reviewed that have served as the basis for the analysis and re-assessment work tasks. Table 1-2 summarizes the correspondence between the report sections and the areas to be reviewed.

**Table 1-2  
REPORT ORGANIZATION**

<b>Areas To Be Reviewed</b>		<b>1 -Introduction</b>	<b>2 – Red Light Running and Accidents</b>	<b>3 – Camera Equipment Installations</b>	<b>4 – Camera Unit Setups</b>	<b>5 – Review of Photographic Data</b>	<b>6 – Traffic Engineering and Traffic Operations Improvements</b>	<b>7 – System Polices and Management</b>
1	Determine if Photo Red Light enforced intersections are safer since the inception of the program		•					
2	Determine if the Photo Red Light Program is the most effective way tom promote traffic safety, and if so, how the program can be expanded		•				•	•
3	Determine criteria and selection process for future locations		•					•
4	Survey the Photo Red Light locations and verify “As Built” documentation which validates or invalidates the fact that the system is functional			•				
5	Inspect and verify the workings of the “Gatsometer” systems and provide documentation which validates or invalidates the fact that the system is functional				•			
6	Provide Recommendations and Cost Analysis on ways to improve the system		•	•	•	•	•	•
7	Provide recommendations and cost analysis as to the feasibility of continuing with the Photo Red Light Program			•	•	•		•
8	Provide information on the most cost effective manner for future deployment of the Photo Red Light Program							•
9	Determine if the timing of the traffic signals is appropriate for the Photo Red Light locations						•	
10	Determine if the Photo Red Light Program is achieving the goal of reducing collisions and educating the public		•					•
11	Survey the system protocols and determine if the system is effectively managed							•